Remarks: Claims

Claims 1-32 are unchanged.

Dependent claims 33-123 were added.

New dependent claim 33 recites the limitation of the encoder being adapted to perform spread-spectrum coding, error correction coding, and/or encryption, which is described throughout the specification, such as on page 23, lines 14-17.

New dependent claim 34 recites an N-point transform, including a Discrete Fourier Transform (DFT), a Fast Fourier Transform (FFT), a Walsh Transform (WT), a Hilbert Transform (HT), a Randomizer Transform (RT), a Permutator Transform (PT), an Inverse DFT, an Inverse FFT, an Inverse WT, an Inverse HT, an Inverse RT, an Inverse PT, which is described throughout the specification, such as on page 24, line 30 to page 25, line 4.

New dependent claim 35 recites the limitation wherein the multicarrier signal generator is adapted to generate a number N of orthogonal multi-frequency signals having a carrier frequency separation of f_s. This is described throughout the specification, such as on page 21, lines 1-9.

New dependent claim 36 recites the limitation wherein the multicarrier signal generator is adapted to provide the carrier signals with at least one set of orthogonalizing properties, including different frequencies, different polarizations, different phase spaces, different transmission locations, different beam directionalities, and/or different spread-spectrum codes. This is described throughout the specification, such as on page 18, lines 14-18.

New dependent claim 37 recites the limitation wherein the multicarrier signal generator is adapted to generate a multi-frequency signal, a frequency-hopped signal, and/or a chirped signal. Such signal generation is described throughout the specification, such as on page 19, lines 4-6.

New dependent claim 38 recites the limitation wherein the carriers are generated with respect to a predetermined multicarrier communication protocol, including OFDM

and MC-CDMA. This is described in the specification, such as on page 43, lines 16-18, and on page 61, lines 1-6.

New dependent claim 39 recites the limitation wherein the multicarrier signal generator is implemented via at least one digital process, including an inverse discreet Fourier transform and an inverse fast Fourier transform. The specification recites the use of digital processing for generating multi-frequency carriers, and describes such examples, including an inverse Discreet Fourier Transform or an inverse Fast Fourier Transform (such as on page 24, lines 22-24).

New dependent claim 40 recites providing the carrier signals with different orthogonalizing properties, which is described throughout the specification, such as on page 18, lines 14-18.

New dependent claim 41 recites providing for frequency hopping the carriers, which is described in the specification, such as on page 19, lines 4-6 and on page 29, lines 17-27.

New dependent claim 42 recites providing a frequency spacing between the carrier signals such that the bandwidth spanned by the carrier signals is larger than at least one predetermined channel's coherence bandwidth. This is described in the specification, such as on page 21, lines 24-28.

New dependent claim 43 recites adapting the superposition of the carriers to generate a CDMA signal and/or a TDMA signal, which is described throughout the specification, such as on page 20, lines 15-20.

New dependent claim 44 recites providing complex code chips to the carrier signals, which is described throughout the specification, such as on page 20, lines 23-26 and on page 24, lines 10-16.

New dependent claim 45 recites modulating at least one information symbol onto the carrier signals, which is described throughout the specification, such as on page 23, lines 9-17.

New dependent claim 46 recites the carrier signals including a number N of orthogonal multi-frequency signals having a carrier frequency separation of f_s, and providing for adjustment of at least one of a set of amplitude and phase of at least one of the carrier signals includes mapping up to N information signals to N orthogonal pulses

per symbol period interval $T = 1/f_s$ wherein the pulses are generated from a superposition of the carriers. This is described throughout the specification, such as on page 21, lines 1-9.

New dependent claim 47 recites providing for an inverse Fourier transform to generate the carrier signals, which is described throughout the specification, such as on page 26, lines 6-11.

New dependent claim 48 recites providing for orthogonal frequency division multiplexing, which is described in the specification, such as on page 43, lines 16-18 and on page 61, lines 29-30

New dependent claim 49 recites separating the multicarrier signal into a plurality of carrier frequency components, which is described throughout the specification, such as on page 35, lines 25-30.

New dependent claim 50 recites sampling the multicarrier signals, which is described throughout the specification, such as on page 37, lines 13-24.

New dependent claim 51 recites the multicarrier signals being a TDMA signal, a DS-CDMA signal, an MC-CDMA signal, an FHSS signal, and/or an OFDM signal. This is described throughout the specification. For example, signals of the invention may employ MC-CDMA or OFDM, such as described on page 43, lines 16-18 and on page 61, lines 1-6. The adaptation of the inventive signaling to TDMA and FHSS are mentioned in the specification, such as on page 29, lines 17-27. The inventive signaling may also employ DS-CDMA, such as described on page 23, lines 19-26 and illustrated in FIG. 5A and FIG. 5B.

New dependent claim 52 recites a matched filter, which is described throughout the specification, such as on page 22, line 21, and illustrated in FIG. 3H.

New dependent claim 53 recites projecting the redundantly modulated multicarrier signals onto at least one orthonormal basis, which is described in the specification, such as on page 22, lines 9-14.

New dependent claim 54 recites compensating for channel distortion, which is described throughout the specification, such as on page 22, lines 9-14.

New dependent claim 55 recites co-phasing, selective combining, maximal-ratio combining, equal-gain combining, and maximal-selection combining, such as described in the specification on page 38, lines 15-20.

New dependent claim 56 recites digitally implementing the steps recited in independent claim 18, such as described in the specification on page 39, line 30 to page 40, line 4, on page 52, lines 26-28, and on page 63, lines 23-26.

New dependent claim 57 further recites an antenna array, which is described throughout the specification, such as on page 60, lines 10-21.

New dependent claim 58 recites a filter bank, which is described throughout the specification, such as on page 36, lines 1-7.

New dependent claim 59 recites a signal processor adapted to perform at least one Fourier transform, which is described throughout the specification, such as on page 36, lines 1-7 and on page 52, lines 24-28.

New dependent claim 60 recites a decoder, which is described throughout the specification, such as on page 35, lines 23-24, and on page 36, line 27 to page 37, line 12.

New dependent claim 61 recites an N-point invertible transform, which is described throughout the specification, such as on page 36, line 27 to page 37, line 12.

New dependent claim 62 recites a decision module adapted to perform at least one of multi-user detection and multi-channel detection, which is described throughout the specification, such as on page 22, lines 18-20 and on page 38, lines 15-20.

New dependent claim 63 recites co-phasing, selective combining, maximal-ratio combining, equal-gain combining, and maximal-selection combining, which are described throughout the specification, such as on page 38, lines 15-20.

New dependent claim 64 recites a digital signal processor, which is described throughout the specification, such as on page 39, line 30 to page 40, line 4, on page 52, lines 26-28, and on page 63, lines 23-26.

New dependent claim 65 recites the carrier signals being provided with at least one of a set of orthogonalizing properties, including different frequencies, different polarizations, different phase spaces, different transmission locations, different beam directionalities, and different spread-spectrum codes. This is described in the specification, such as on page 18, lines 14-18.

New dependent claim 66 recites frequency-diverse signals, including a multi-frequency signal, a frequency-hopped signal, and a chirped signal. This described throughout the specification, such as on page 19, lines 4-6.

New dependent claim 67 recites signals that comply with a predetermined multicarrier communication protocol, including OFDM and MC-CDMA, which is described throughout the specification, such as on page 43, lines 16-18 and on page 61, lines 1-6.

New dependent claim 68 recites at least one multiple-access scheme being provided by the transmitter, including code division multiple access, frequency division multiple access, and time division multiple access. This is described throughout the specification, such as on page 20, lines 15-20 (which mentions CDMA and TDMA) and on page 43, lines 16-18 and page 61, lines 1-6 (which mention MC-CDMA and OFDM).

New dependent claim 69 recites complex code values modulated onto the carriers, which is described throughout the specification, such as on page 20, lines 23-26.

New dependent claim 70 recites code-division multiplexing a plurality of data symbols. The inventive signaling described in the specification may employ DS-CDMA, such as described on page 23, lines 19-26 and illustrated in FIG. 5A and FIG. 5B.

New dependent claim 71 recites code values that synthesize a CDMA and/or a TDMA signal. Such coding is described in the specification on page 20, lines 15-20 and on page 23, lines 19-26.

New dependent claim 72 recites a number N of orthogonal multi-frequency signals having a carrier frequency separation of f_s, and the carrier-code generator and the information-signal modulator being adapted to provide for up to N orthogonal information-modulated pulse waveforms from a superposition of the carriers within a given symbol interval $T = 1/f_s$. This is described throughout the specification, such as on page 21, lines 1-9.

New dependent claim 73 recites a plurality of multi-frequency carrier signals distributed over at least one frequency band whose bandwidth exceeds a given communication channel's coherence bandwidth, which is described throughout the specification, such as on page 21, lines 20-23.

New dependent claim 74 recites providing the plurality of carrier signals with at least one set of diversity parameters that provide uncorrelated fading between at least two of the carrier signals. This is described in the specification, such as on page 21, lines 24-28.

New dependent claim 75 recites implementing carrier generation with a digital process, including an inverse discreet Fourier transform and an inverse fast Fourier transform. This is described throughout the specification, such as on page 24, lines 22-24.

New dependent claim 76 recites the carrier-signal generator being implemented with an invertible transform, and at least one of the carrier-code generator and the information-signal modulator including at least one output coupled to a plurality of input bins of the invertible transform. This is described throughout the specification, such as on page 24, lines 22-25.

New dependent claim 77 recites the carrier-code generator including at least one N-point transform, including a Discrete Fourier Transform (DFT), a Fast Fourier Transform (FFT), a Walsh Transform (WT), a Hilbert Transform (HT), a Randomizer Transform (RT), a Permutator Transform (PT), an Inverse DFT, an Inverse FFT, an Inverse WT, an Inverse HT, an Inverse RT, an Inverse PT. This is described throughout the specification, such as on page 24, line 30 to page 25, line 4.

New dependent claim 78 recites a multi-stage code generator, which is described in the specification, such as on page 24, lines 29-30.

New dependent claim 79 recites a filter adapted to filter at least one of the carrier signals, which is described throughout the specification, such as on page 26, lines 6-11.

New dependent claim 80 recites providing at least one complex code to the weighted information signals, which is described throughout the specification, such as on page 20, lines 23-26, page 23, lines 19-26, and page 24, lines 10-16.

New dependent claim 81 recites performing at least one N-point invertible transform, such as described in the specification on page 24, line 30 to page 25, line 5.

New dependent claim 82 further recites an invertible transform, such as described on page 36, lines 1-7 of the specification.

New dependent claim 83 further recites multi-user detection and multi-channel detection, such as described in the specification on page 39, line 30 to page 40, line 4, on page 52, lines 26-28, and on page 63, lines 23-26.

New dependent claim 84 recites at least one digital signal processor adapted to perform an N-point invertible transform, which is described throughout the specification, such as on page 36, lines 1-7, page 39, line 30 to page 40, line 4, on page 52, lines 26-28, and on page 63, lines 23-26.

New dependent claim 85 recites a filter bank, which is described throughout the specification, such as on page 36, lines 1-7.

New dependent claim 86 recites at least one combiner adapted to combine the information-modulated carrier signals, such as described on page 38, lines 15-20 of the specification.

New dependent claim 87 recites a digital signal processor, which is described throughout the specification, such as on page 39, line 30 to page 40, line 4, on page 52, lines 26-28, and on page 63, lines 23-26.

New dependent claim 88 recites combining the multicarrier signals to generate at least one superposition signal and processing the at least one superposition signal in the time domain. This is described throughout the specification, such as on page 49, lines 11-12, on page 37, lines 13-24, and on page 35, lines 3-11.

New dependent claim 89 recites compensating for channel distortions, which is described throughout the specification, such as on page 22, lines 9-14.

New dependent claim 90 recites filtering the multicarrier signals, such as described in the specification on page 35, lines 25-30 and on page 37, lines 13-24.

New dependent claim 91 recites providing for digital signal processing, such as described on page 39, line 30 to page 40, line 4, on page 52, lines 26-28, and on page 63, lines 23-26.

New dependent claim 92 recites performing at least one type of Fourier transform, which is described throughout the specification, such as on page 36, lines 1-7.

New dependent claim 93 recites providing for at least one of multi-user detection and multi-channel detection, which is described throughout the specification. For

example, multi-user detection is described on page 29, lines 21-27 and multi-channel detection is described on page 39, line 7.

New dependent claim 94 recites decoding and demodulating the multicarrier signals, which is described throughout the specification, such as on page 35, lines 23-24, and on page 36, line 27 to page 37, line 12.

New dependent claim 95 recites the step of providing for processing of the multicarrier signals with respect to at least one alternative diversity parameter being adapted to process at least one frequency-hopped multicarrier signal. Frequency hopping is described throughout the specification, such as on page 19, lines 4-6 and on page 29, lines 17-27.

New dependent claim 96 recites a filter bank, which is described throughout the specification, such as on page 37, lines 13-24.

New dependent claim 97 recites the sampler being adapted to adjust relative phases of sampled signals to reconstruct time-domain signals occurring in a plurality of time intervals, which is described throughout the specification, such as on page 37, lines 13-24.

New dependent claim 98 recites a phase-space decoder, which is described throughout the specification, such as on page 29, lines 21-27.

New dependent claim 99 recites the sampler is adapted to sample at least one multicarrier frequency-hopped signal, which is described throughout the specification, such as on page 19, lines 4-6 and on page 29, lies 17-27.

New dependent claim 100 recites providing for filtering the plurality of information-modulated multicarrier signals, which is described throughout the specification, such as on page 35, lines 25-30.

New dependent claim 101 recites separating the plurality of information-modulated multicarrier signals from at least one other signal, which is described throughout the specification, such as on page 35, lines 25-30.

New dependent claim 102 recites separating the plurality of information-modulated multicarrier signals into a plurality of frequency components for generating the received multicarrier signals, which is described throughout the specification, such as on page 37, lines 13-24, and on page 35, lines 25-30.

New dependent claim 103 recites applying at least one Fourier transform to the plurality of information-modulated multicarrier signals for generating the received multicarrier signals. This is described throughout the specification, such as on page 36, lines 1-7.

New dependent claim 104 recites processing at least one of a set of multicarrier signal formats, including frequency-hopped signals and OFDM signals. Adaptations of the invention for frequency hopped signaling are described throughout the specification, such as on page 19, lines 4-6, and on page 29, lines 17-27. Adaptations of the invention for OFDM signaling are described throughout the specification, such as on page 43, lines 16-18 and on page 61, lines 1-6.

New dependent claim 105 recites adjusting signal phases of the received multicarrier signals to produce a sequence of information-modulated pulse waveforms, such as described on page 37, lines 13-24, and illustrated in FIGs 5A and 5B.

New dependent claim 106 recites providing for at least one of a set of diversity combining processes, including co-phasing, selective combining, maximal-ratio combining, equal-gain combining, and maximal-selection combining. Each of these combining techniques are recited in the specification on page 38, lines 15-20.

New dependent claim 107 recites providing for a decoding process that employs an invertible transform, which is described throughout the specification, such as on page 36, line 27 to page 37, line 12.

New dependent claim 108 recites compensating for channel distortion, which is described throughout the specification, such as on page 22, lines 9-14.

New dependent claim 109 recites projecting the plurality of information-modulated multicarrier signals onto at least one orthonormal basis of at least one transmitted signal, which is described throughout the specification, such as on page 22, lines 9-14.

New dependent claim 110 recites frequency hopping the plurality of multicarrier signals. Adaptations of the invention for frequency hopped signaling are described throughout the specification, such as on page 19, lines 4-6, and on page 29, lines 17-27.

New dependent claim 111 recites a frequency-diverse transmission source, such as defined in the specification on page 19, lines 4-6.

New dependent claim 112 recites frequency interleaving subcarriers of the multicarrier signals, such as described in the specification on page 21, lines 24-28.

New dependent claim 113 recites generating at least one multicarrier signal having a superposition characterized by at least one of a set of single-carrier signal formats, including a TDMA signal and a CDMA signal. This is described throughout the specification, such as on page 20, lines 15-20.

New dependent claim 114 recites a coder adapted to modulate at least one set of complex code chips onto at least one of the plurality of sets of multicarrier signals, such as described on page 20, lines 23-26 and on page 23, lines 19-26.

New dependent claim 115 recites modulating channel compensation values onto at least one of the plurality of sets of multicarrier signals, such as described in the specification on page 20, lines 26-29.

New dependent claim 116 recites adapting the multicarrier signal generator to generate the plurality of multicarrier signals having a number N of subcarriers with an orthogonal carrier frequency separation of f_s, and the modulator is adapted to provide for up to N orthogonal information-modulated pulse waveforms from a superposition of subcarriers in at least one of the plurality of sets of multicarrier signals within a given symbol interval $T = 1/f_s$. This is described in the specification on page 21, lines 1-9.

New dependent claim 117 recites at least one signal processor adapted to perform an inverse Fourier transform, which is described throughout the specification, such as on page 26, lines 6-11.

New dependent claim 118 further recites an antenna array, which is described throughout the specification, such as on page 60, lines 10-21.

New dependent claim 119 further recites providing at least one N-point invertible transform, which is described throughout the specification, such as on page 36, line 27 to page 37, line 12.

New dependent claim 120 recites separating the sets with respect to at least one of a set of diversity parameter values, including different frequencies, different time intervals, different polarizations, and different spatial locations. This is described throughout the specification, such as on page 18, lines 14-18.

New dependent claim 121 recites performing at least one invertible transform, which is described throughout the specification, such as on page 36, line 27 to page 37, line 12.

New dependent claim 122 recites a combining process that performs at least one invertible transform, which is described throughout the specification, such as on page 36, line 27 to page 37, line 12.

New dependent claim 123 recites performing at least one of a set of signal-processing operations, including decoding, multi-channel detection, and multi-user detection, which is described throughout the specification, such as on page 29, lines 21-27, and on page 47, lines 25-27.

Very respectfully,

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